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Assessing natural and anthropogenic forcing and conditioning factors in transgressive dune fields in the last two centuries

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Introduction

Transgressive dune fields evolution varies along the coastline as a result of both natural factors and human activities**.** Under distinct climatic conditions and sea level fluctuation, coastal dune fields recorded intense sand drift episodes, and significant changes in their morphologies. Wind-blown sand transported inland, invaded agricultural fields, silted the rivers and estuaries and destroyed villages, forcing the inhabitants to move elsewhere. The proposed doctoral project in Physical Geography aims for the dissemination of the project - "Sea, Sand and People. An Environmental History of Coastal Dunes" (802918-DUNES-ERC-2018-STG). The main objective is to reconstruct the geomorphological evolution of transgressive dune fields during the last two centuries, as a response to environmental and anthropogenic factors and assessing the coastal dunes ecosystems vulnerability.

Key-words: : geomorphological evolution, environmental history, sand drift, anthropogenic impacts, soil uses, dunes vulnerability, coastal management.

Study areas

Two dune systems will be studied in this research. The forested one, accumulated under prevailing NW winds (westerlies conditions) which overlays the occupational area between Figueira da Foz and Nazaré villages (western coast of Portugal). The second one, is an active dune system located on the Ceará coast (NE Brazil), strongly influenced by the displacement of the Intertropical Convergence Zone (ITCZ) and weather conditions in the Northern Hemisphere (Nimer, 1979). The seasonal movements of the ITCZ also control wind directions . prevailing NE winds in January, when the ITCZ is at its most southern location and from SE direction in July, when ITCZ returns to its northernmost position (Carvalho et al., 2016).

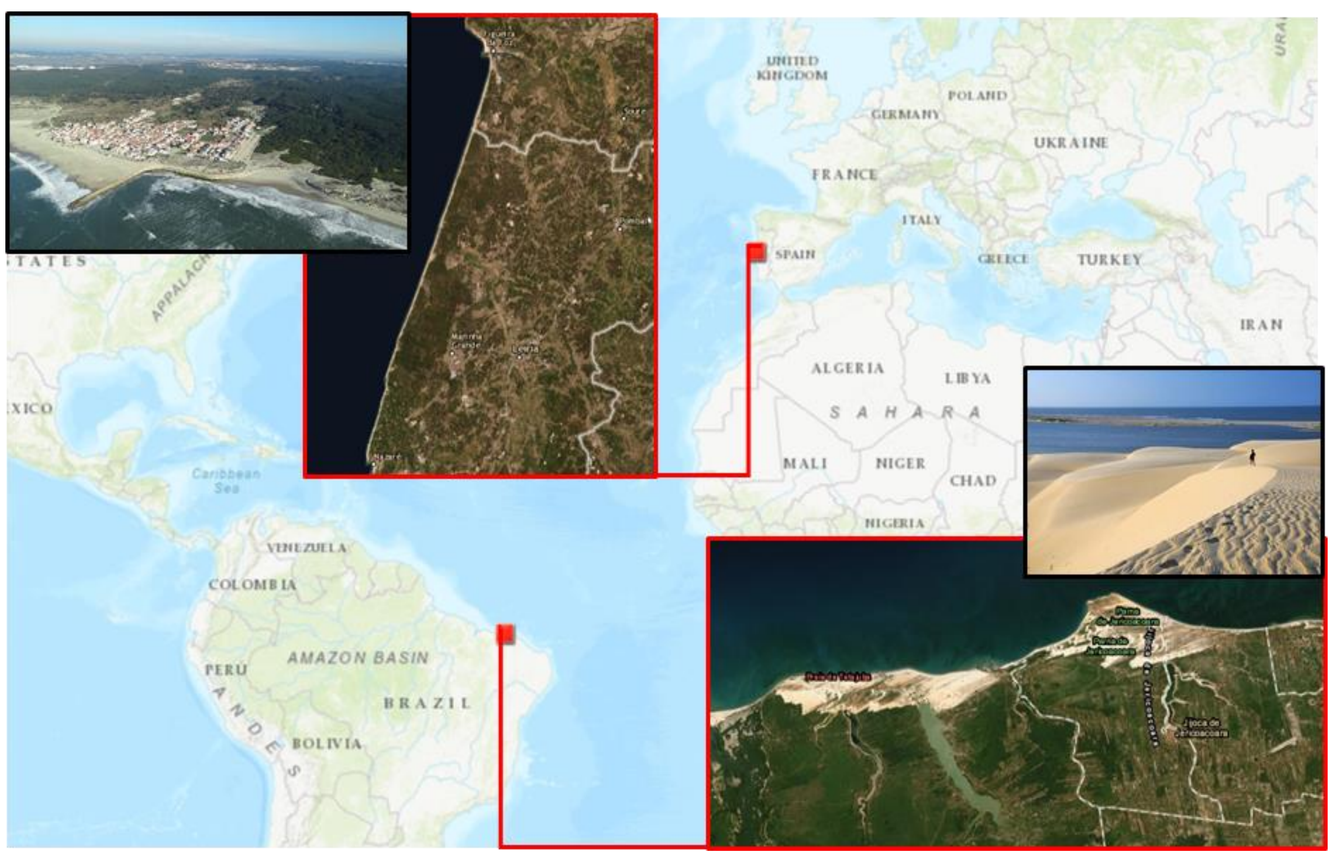

Figure 1. Study areas and location at regional and global scale.

Expected results

- A combined geomorphological, radiocarbon and/or OSL dating, and historical approach will allow to determine pulses of intense aeolian activity and dune migration inland and phases of dune stability and soil formation.
- The study would help to establish spacetime geomorphological evolution and sedimentary dynamics through different conditioning factors, such as climate, marine dynamics, variations of sea level and anthropogenic activity.
- Using high resolution satellite images series would help us to define the pattern of aeolian transport and assess the natural forcing and conditioning factors of dune morphological changes.
- In addition, the historical sources will provide further understanding of the negative impact on the society and economic activity and human intervention on dunes to prevent sand drifting.
- Combination of the physical and anthropogenic factors will be used for the prediction morphological modelling applied for assess coastal dune evolution and vulnerability.

Methodology

The methodology proposed is divided in 2 major groups regarding: i) the natural evolution of coastal dunes and ii) the human induced evolution, organized into eight minor tasks.

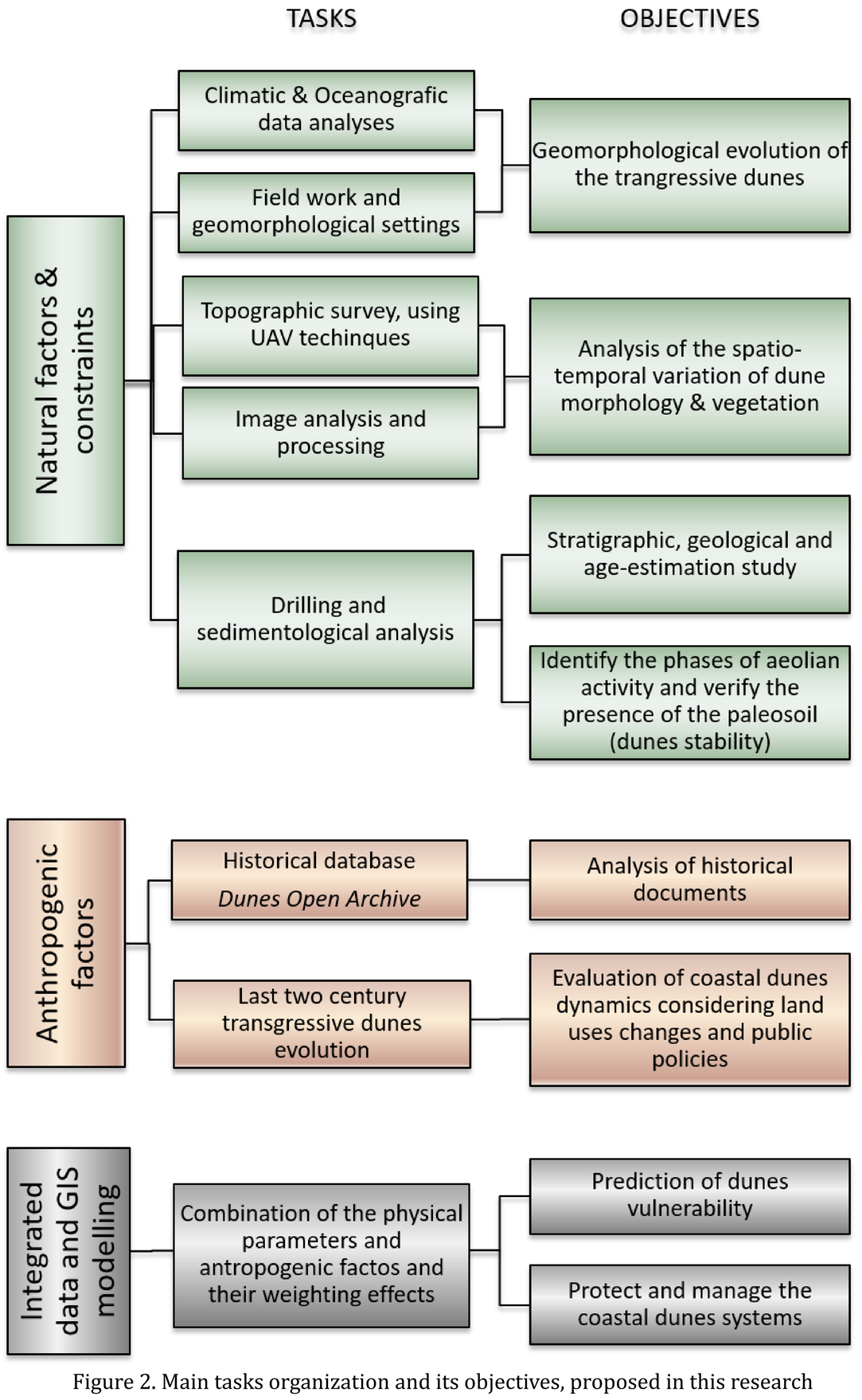

Figure 2. Main tasks organization and its objectives, proposed in this research

Discussion and conclusion

It is expected that the project provides innovative results and new insights of the coastal zone evolution at a long term scale, through the cross-referencing of geographical information with historical records and relevant knowledge considering the need of efficient coastal management solutions to adapt to climate changes and sea level rise. The data will be integrated in a spatial database, available in open format at the end of the project, in the repository of the University of Lisbon and accessible through the Dunes Open Archive Platform, built under the DUNES Project.

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